RENEWAL SAN BERNARDINO TUNNEL

Renewal San Bernardino Tunnel

The San Bernardino tunnel provides a winter safe link between the Canton of Grisons with the – Canton Ticino and is part of the Swiss motorway network A13, Bellinzona – Chur, Switzerland.

Scope

- Renewal of the roadway and installation of cable ducts, tunnel length 6’596 m
- Construction of 12 niches for jet ventilators and 17 emergency galleries to the future escape to rescue tunnel below the roadway.
- Complete replacement of the roadway slabs.
- Renewal of the hydrant/drainage system.
- Renovation of vault and suspended ceiling
- Installation of pre-fabricated wall framework

Challenges

- Renovation and replacement of roadway during continuation of traffic by means of a controlled traffic management system (one way traffic only at construction area)
- Opening of the new roadway sections 24h after hardening of concrete
- Drill& Blast (D&B) heading for excavation of niches and emergency exits during operation

Amberg Services

- General project management
- Coordination of tunnel operation with construction works in connection with the local police office
- Site supervision and technical consulting of client
- Involvement for provision of tendering documents and evaluation of offers
- Development of concept for wall framework including optimized construction material
- Establishment of traffic and safety concept for tunnel operation during construction works

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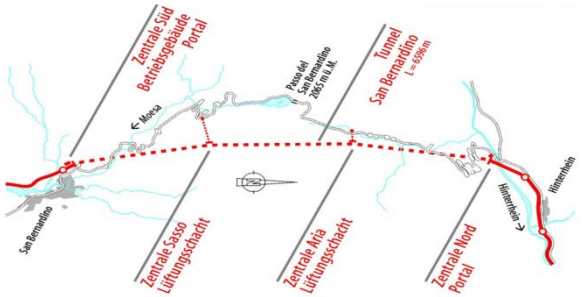

- Location of San Bernardino tunnel and situation

- Roadway slabs requiring urgent renovation

- Development of site using tunnel train

AMBERG FACTS

Contracted value Amberg

- Total 6.346 Mio. CHF

Project phases & duration

- Planning 1989 – 2004
- Construction 1998 – 2008

Project details

Replacement of Roadway

- Removal of old roadway during operation, cutting of roadway segments in transportable pieces.
- Lowering of tunnel floor for escape& safety tunnel
- Building of escape & safety tunnel as cast in place construction.
- Construction of roadway (cast in place), special concrete with quick setting cement.

Ventilation niches

- Excavation of rock for niches
- Lining of niches
- Mounting of Ventilators

Connecting gallery, escape & safety tunnel

- D & B excavation of connecting gallery
- Lining with shotcrete
- Connection to rescue & safety tunnel

CLIENT FACTS

Total cost

- Total 240 Mio. CHF

Overview project

- National motorway A13c (Canton of Grisons), renewal road tunnel, length 6'596 m
- Renewal of roadway, construction of cable ducts
- Construction of 12 niches for jet ventilators and 17 emergency exits to the future escape & safety tunnel below roadway.

Geology

- Crystalline rock mainly Gneisses

Contact person

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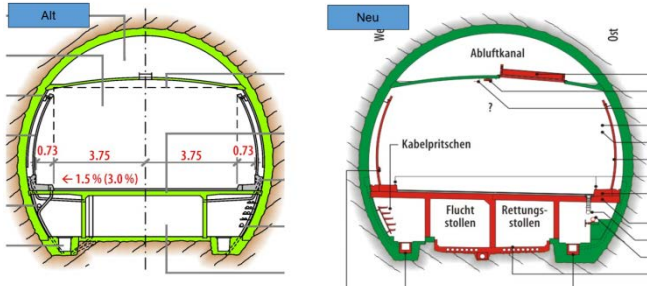
CHALLENGES

Removal of old roadway slabs, driving lane right side

Renewal works under operation

- Maintaining of one way traffic in the area of the construction site
- Sophisticated traffic management concept, despite of construction site traffic, the tunnel could be used for two way traffic, except in area of construction site
- Full integration of site logistics in traffic concept.
- Transport of old roadway slabs by tunnel train

TECHNICAL APPROACH

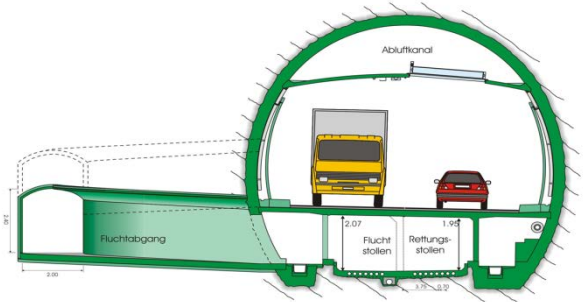


Profile old and new (right) with rescue / safety tunnel

Escape & safety tunnel under roadway

- Complete replacement of roadway and structures below
- Lowering of area of the old ventilation gallery for the building of the new rescue & safety tunnel
- Measures for extreme climatic conditions (concrete works), because the site is at 1‘600 above sea level, temperatures in winter down to -20°C
- Preheating of concrete at transport, heat able housing in the area of concrete works in driving area

TECHNICAL SOLUTIONS



Emergency exit with connecting gallery

Ventilation niches, emergency exit with connecting gallery

- Renewal of the entire safety installations
- Fire detector plus radiation cables for radio reception and radio communication as well as for GSM / UMTS mobile access antenna
- Video camera every 150m, CO and und sight reduction monitoring device plus wind speed meters every 400m, fire emergency lights every 50 m and an optical guiding system for emergency
- Escape and safety tunnel below the roadway with exits at the portals. Escape exits every 350 resp. 375 m down to the rescue & safety tunnel via escape galleries
- SOS Niches every 250 m
- Hydrant pipe with hydrants every 140 m
- Group of 6 jet ventilators in wall niches at every third of the tunnel length

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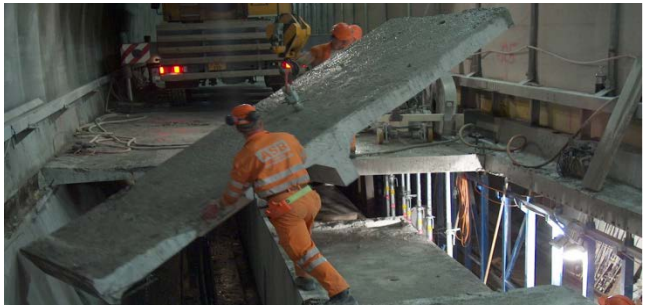
CHALLENGES

- Step 1: Lowering of tunnel floor

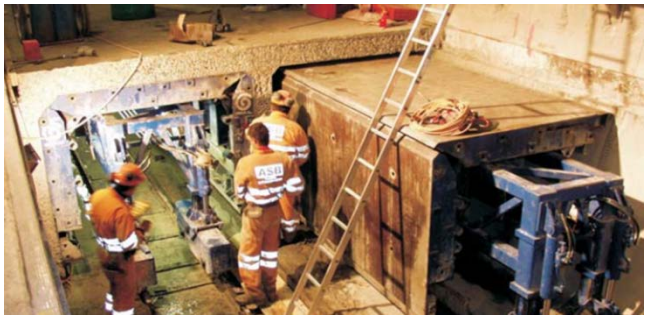
- Step 2: Supporting of slabs in centre of roadway

- Step 3:Cutting of slabs in transportable pieces

TECHNICAL APPROACH



- Step 4: Removal of cut slabs

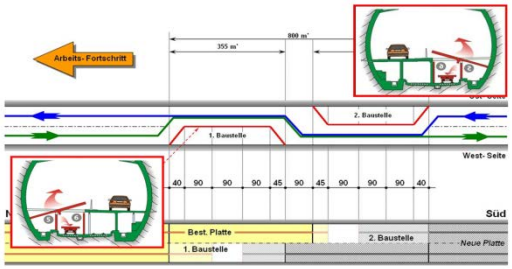


- Step 5: Cast in place of escape & safety tunnel

- Step 6: Concrete casting of new roadway

TECHNICAL SOLUTIONS

- Step 7: Installation of wall framework



- Sequential construction operation on 2 subsites

- Tunnel after completion of renewal

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